



Combined Heat and Power (CHP) and Distributed Energy Resources (DER)
Summary and Synthesis of Regulatory and Administrative Impediments

Prepared for:
Virginia Department of Environmental Quality (DEQ)

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Combined Heat and Power and Distributed Energy Resources Regulatory and Administrative Impediments

Executive Summary

Distributed energy resources can provide a solution to many of Virginia's current and future energy needs. In order for possibility to be fully realized, a complex array of technical, regulatory, policy, environmental, security and financial barriers need to be overcome. Federal initiatives have resolved some constraints, but there is a considerable agenda remaining. This paper describes many of the barriers and proposed solutions, including the need for state-based efforts to disseminate the requisite information to local government and the private sector. - MW

What is Distributed Energy?

Distributed energy resources (DER) refers to the decentralized generation of electric power in small- to medium-sized facilities near sites of power demand, in contrast to large centralized electrical generating plants.¹ DER facilities can often incorporate recovery of useful heat energy (combined heat and power, or CHP) for space, water, and process heating as well as to run chillers to provide refrigeration. DER offers a means to improve energy efficiency by reducing power transmission losses and allowing use of otherwise wasted byproduct heat. It can take advantage of combustible wastes and scraps as well as biogases that are often flared away at landfills, wastewater treatment works, and other facilities, with commensurate cost savings. Both fossil fuels and renewable resources can be applied to DER.

DER can enhance power reliability and quality for operations that are highly sensitive to power outages and fluctuations, such as data centers, communications facilities, high technology manufacturing, health care, emergency services, and defense, among others. Improved energy efficiency and new low emissions technologies, such as advanced gas turbines, microturbines, fuel cells, and renewable sources, offer significant environmental advantages. Among them, reduced emissions of air pollutants and carbon dioxide as well as reduced impacts of fuel production. Furthermore, DER can potentially mitigate stresses to the electric grid from generation and transmission constraints.²

Distributed Generation and Virginia's Energy Future

Distributed generation is poised to become a key element in Virginia's - and the nation's - energy future. However, the promise of distributed energy resources has yet to be fully realized due to a combination of technical, regulatory and business practice barriers,

¹ DER is sometimes referred to as distributed generation (DG).

² DEQ Combined Heat & Power/Distributed Energy Resources Pages. See <http://www.deq.virginia.gov/innovtech/der1.html>

compounded by uncertainties associated with nationwide electricity market deregulation and utility restructuring. A recent U.S. Department of Energy (DOE) study outlines many of these barriers, some of which have been shown to block "viable projects with potential benefits to both the customer and the utility system."³

In fact, Virginia offers a case in point, as well as a good testing ground, for many of the issue cited by DOE. What is known with certainty is that Virginia's future needs are undergoing significant change, with new dynamics. The essential elements of this change include large localized electrical power needs; requirements for significantly increased power stability, availability and reliability; increased square foot wattage of facilities; and the growth of dedicated power systems. In addition, events such as Hurricane Isabel and other weather events, the August 2003 blackout in the Northeastern and Midwestern United States and the potential for deliberate attacks on critical infrastructure systems underscore the need to re-evaluate the role of distributed energy systems in assuring energy security throughout the Commonwealth. These applications include the following:

Standby Power is used where electric service interruption either impacts public health and safety or causes irreparable economic loss. Examples are hospitals, water pumping stations, and computer chip manufacturing facilities.

Peak Shaving is the use of on-site power during relatively high-cost peak periods of utility power generation to reduce cost and alleviate grid congestion. Examples are office buildings, schools, and hotels.

Combined Heat and Power (CHP) is the application of waste heat energy derived from an on-site power source to power heating-ventilation-and-air conditioning (HVAC), or provide process heat. Examples are large commercial buildings and process industries.

Grid Support is the strategic placement of power where the grid has problems sustaining power delivery due to the length or configuration of the transmission and distribution grid.

Stand Alone Distributed Generation is used where transmission and distribution grid service is not an option. Examples are lighthouses and other remote stations, auxiliary power units for emergency services or military applications, and manufacturing and other facilities using delicate electronics or otherwise having extremely high power reliability and quality requirements.

Distributed Energy Status in Virginia: Research Initiatives

Two efforts described below, which have attempted to identify both opportunities and obstacles affecting the market penetration of distributed energy systems in Virginia, form the basis of the following sections of this report. Very recently, increased concerns about critical infrastructure security as a public good and uncertainties surrounding electricity

³ "Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects", Prepared under Subcontracts No. CXE9-29093-01 and CXE9-29092-01, National Renewable Energy Laboratory under DOE Contract No. DE-AC36-99-GO10337.

market deregulation have added to the complex set of issues. To the extent possible, these have been incorporated into the report.

DEQ and Distributed Energy

In order to better understand, anticipate and overcome barriers to effective deployment of DER and CHP in Virginia, the Virginia Department of Environmental Quality (DEQ) initiated a project in 2001 to examine the administrative and regulatory barriers to CHP and DER in the Commonwealth. The effort was financially supported by the U.S. Department of Energy (DOE) and the Virginia Department of Mines, Minerals, and Energy (DMME) as a State Energy Program Special Project.

As part of the study, an initial survey was conducted that included numerous interviews and concluded with a summary of the potential impediments to DER/CHP.⁴ The second phase of this project included a series of workshops to discuss what solutions may exist to deal with the impediments. URS Corporation, a national engineering consulting firm, was hired by DEQ to facilitate the workshops in 2003. Groups of stakeholders were brought together over a series of four workshops throughout the Commonwealth of Virginia, made up of technology vendors, regulatory agencies, utilities, consultants, environmental and consumer organizations, other NGOs, and local government officials.⁵

More recently, DEQ staff participated in a Mid-Atlantic CHP Application Center Roadmapping Workshop convened by the Mid Atlantic Combined Heat and Power Application Center. The Center, which was created with funding from DOE to promote the use of CHP in the Mid-Atlantic Region, seeks to reduce the perceived risk of CHP to users, foster CHP as a viable technical and economic option for the participating region, and to capitalize on existing regional CHP resources.⁶ Toward that end, the Center will assist organizations to locate, design and implement economically viable distributed energy projects that make appropriate use of their recoverable waste heat.

Virginia Tech and Distributed Energy

In parallel with the DEQ activities, the Virginia Polytechnic Institute and State University (Virginia Tech) Alexandria Research Institute (ARI) initiated the Critical Infrastructure Modeling and Assessment Program (CIMAP) to assess critical infrastructures in Northern Virginia. The aim of this program has been to provide state policymakers and legislators - along with citizens, state and federal agencies as well as industry partners - with long-term perspectives and guidance on the various issues that affect the planning, commissioning and operation of infrastructures.

As part of the CIMAP program, a Distributed Energy Resources Workshop, coordinated by ARI and co-hosted by the Virginia State Corporation Commission (SCC), was held in Richmond, Virginia in May 2002. The workshop focused on identifying the implications

⁴ Consensus Solutions, Inc. prepared the Convening Assessment Report, dated May 30, 2002. Available via the DEQ Innovative Technology website.

⁵ Notes assembled by URS Corporation on the DEQ CHP/DER Workshops held March 4, April 3, May 6, and June 5, 2003. Available via the DEQ Innovative Technology website.

⁶ The region includes Delaware, the District of Columbia, Maryland, New Jersey, Pennsylvania, Virginia, and West Virginia.

of distributed resources for the various major stakeholders and suggesting a role for the Commonwealth in developing policies to promote, control or otherwise affect their development.

A second ARI Combined Heat and Power Workshop, held in May 2003, addressed how best to realize the technical and market potential of commercial and institutional sector CHP development in Virginia, with particular attention to the environmental implications for the localities in the Commonwealth's ozone non-attainment areas.

More recently, ARI, in conjunction with the DEQ, convened an Energy Futures Workshop in Charlottesville, Virginia on June 2004. The one-day session sought to identify key opportunities and obstacles affecting the Commonwealth's energy future, with primary emphasis on assuring a diversified, environmentally responsive and secure energy supply for its citizens. The meeting also served as a lead-in to the Mid-Atlantic CHP Application Center workshop cited earlier.

Distributed Energy Systems: Increasing Network Reliability And Availability

Considerable change and uncertainty in the electrical power sector confront implementation of distributed energy systems in Virginia. A recent article in Reliability Engineering and System Safety provides a brief summary of these:

That electric supply system has over the past decade taken on significantly greater loads (power demands) and has also undergone a makeover from being a highly regulated, vertically integrated utility industry to one that is partially deregulated, far less unified and not so robust and resilient as it was. The generation side is essentially deregulated and operating under an open market set of conditions where competitive price, low operating costs and return on investment are rewarded with profits and bonuses. At the same time the transmission sector remains fully regulated and limited from taking steps to meet growing demand with new capacity by uncertainty in knowing how such investments will be paid for under regulatory bodies that are tasked to see that power is delivered to rate payers at minimum cost. Where possible, operating costs have been reduced by installing automated cyber controllers, supervisory control and data acquisition (SCADA) units and local area networks (LANs), to perform the functions that people had previously performed. In general, control is now more centralized, spare parts inventories are reduced, and systems are highly integrated across entire regions.

This dramatic change has played out with the result that the in-place electrical systems assets today are typically being operated very efficiently at close to the limit of available capacity. In this mode, another characteristic of such systems appears. When operated near their capacity, these systems have little margin within which to handle power or load fluctuations. Thus, they are quite vulnerable to being brought down by operating fluctuations that exceed their remaining margins. Shutting down becomes the only way a system element has of protecting itself from severe damage when load exceeds capacity. But the loss of a piece of the grid, a section of transmission line, does not end the problem.

The line down takes with it the power it was transmitting. A connected power plant, having no connected load must also shut down. In these highly integrated grids, more lines have imbalance problems and more plants sense capacity problems and so also shut down. This cascading spreads very rapidly in many directions and in seconds, an entire sector of the North American grid can be down.⁷

As implied by the above, the reliability and security components of electrical services are closely linked; in one sense, they differ only in their predictability: essentially statistical for typical reliability determinations, and generally based on a detailed historical record, while security concerns (both physical and cyber) are far less amenable to modeling and analysis. Distributed energy systems arguably can contribute to strengthening both areas, as noted by a recent National Science Foundation study:

Fortunately, the core technologies needed to strategically enhance system security are the same as those needed to resolve other areas of system vulnerability, as identified in the *Electricity Technology Roadmap*. These result from open access, exponential growth in power transactions, and the reliability needed to serve a digital society.⁸

Energy Reliability

Reliability of energy supply is ensured by enabling rapid deployment where needed, by providing on-site grid independent services, and by consistently meeting power quality needs. The compact, quite, low-emissions distributed generation systems can be readily installed almost anywhere. (Although it should be noted that many existing DER assets, such as emergency backup diesel generators lacking pollution controls, are relatively highly polluting.) On-site power eliminates service disruptions caused by grid damage or adjustments to overloads, and provides the power quality needed in many industrial applications dependent upon sensitive electronic instrumentation and controls.⁹

Distributed generation, in particular, carries an additional positive attribute because it allows the grid to separate into smaller islands during a system failure. Distributed generation can provide a network of small power sources in urban areas and supplement traditional central station units, which will (at least for the currently foreseeable future) still provide the bulk of our power supply. In the future, all of these resources might be linked by a smart network of web-based and wireless controllers responding to load and market conditions.

⁷ "Confronting The Risks Of Terrorism: Making The Right Decisions", Reliability Engineering and System Safety 86 (2004) 129–176

⁸ North American Electricity Infrastructure: System Security, Quality, Reliability, Availability, and Efficiency Challenges and their Societal Impacts, Massoud Amin.. Chapter 2 in the National Science Foundation (NSF) report on "Continuing Crises in National Transmission Infrastructure: Impacts and Options for Modernization," June 2004

⁹ Distributed Generation: Ensuring Energy Security, Reliability, And Efficiency, U. S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory. See http://www.netl.doe.gov/scng/enduse/refshelf/Dist_Gen_brochure_final_1.pdf

However, grid reliability and security can be enhanced today, even without a high degree of real-time integration, simply by the gradual displacement of large and remote power sources with smaller resources closer to load. It should be noted that increased reliance on internet-based controls in the electrical power sector, including those required to integrate these distributed energy resources into the grid, is not without concomitant risk, as wireless and web-based controls introduce their own vulnerabilities to accidents or intentional cyber-attack.

The times when demand-side and distributed resources will be most effective in addressing security concerns are also the times of greatest financial value. In most power systems, ten percent of installed capacity is needed only one percent of the hours in a year. During those few hours, wholesale market prices are at their highest, reserve margins are at their lowest, and the grid is most vulnerable to unplanned disruptions. Distributed resources can deliver greater reliability and security, while lowering power costs.¹⁰

Energy Security

In contrast with quantitative measures of electrical system reliability, quantitative attempts to assess energy security are considerably less informed, due in large measure to both the rapidly-changing nature of the electrical system infrastructure and the lack of a robust historical data set. In addition, energy security has to be considered in the context of both intentional and natural (e.g. hurricanes, ice storms) system disturbances. These include the following type:

Intentional Threats

In broad terms, both the near-term and longer-term security assessments by the Electric Power Research Institute (EPRI) encompass three categories of vulnerability for electric power systems (power plants, transmission lines, and substations):

- Attacks *upon* the system, in which the system itself is a primary target, with ripple effects (outages) extending to utility customers
- Attacks *by* the system, in which part of the power system is used as a weapon against the general population
- Attacks *through* the system, in which utility networks—including power lines, pipelines, underground cables, tunnels, and sewers—are used as multiple conduits for attacks against targets ranging from the population and infrastructure to businesses and the military.

According to Karl Stahlkopf, EPRI vice president for power delivery, “One of the most critical needs of the industry with respect to security is a rigorous assessment of the risks posed by terrorism. This type of analysis has been done for naturally occurring risks and for evaluating the safety of nuclear power plants, but not for the type of risks imposed by terrorist activity.”¹¹

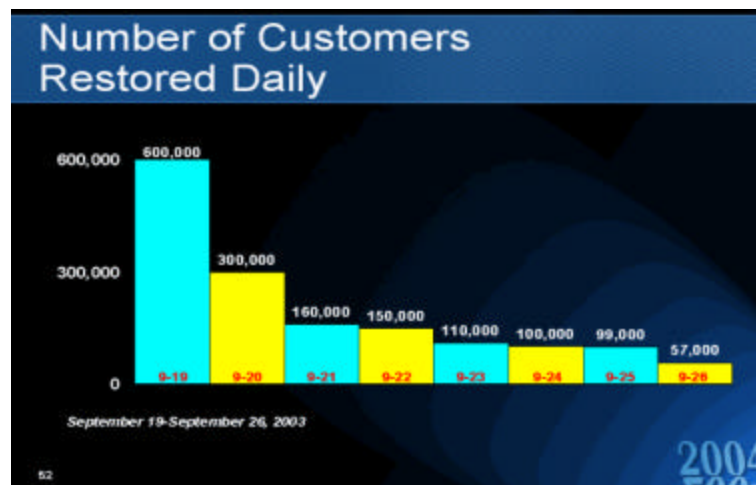
¹⁰ RAPG IssuesLetter, Electrical Energy Security: Policies for a Resilient Network, Part II, April 2002

¹¹ Assessing the Terrorist Threat to Power Systems. See <http://www.epri.com/journal/details.asp?id=259&doctype=news>

As envisioned by DOE, "energy security is strengthened by enabling a variety of low cost domestic energy resources, by reducing the fuel use through major efficiency gains, and by reducing electricity delivery infrastructure vulnerability to terrorist attack and natural disasters."¹² While it is true that the current portfolio of distributed generation systems offers fuel-flexible choices, capable of operating on natural gas, transportation fuels, and synthesis gas derived from coal, biomass, or wastes, individual technologies or facilities are not necessarily fuel-flexible. Some of these systems (particularly later-generation) can be strategically dispersed anywhere because of their compactness and quiet, environmentally sensitive operation, although the use of diesels or coal-fired DG/CHP may be constrained in environmentally sensitive areas or require expensive pollution controls.

Interdependency Implications – Where Reliability And Security Concerns Meet

The impacts of major storms such as Hurricane Isabel (September 2003) have starkly demonstrated the vulnerabilities both within infrastructures and between infrastructures. As a consequence of Isabel, for example, eighty percent of Dominion Virginia Power electric customers in Virginia and part of neighboring North Carolina - about 1.8 million homes and businesses - lost power, some for up to two weeks. As reported in December 2003, Dominion identified \$128 million as its after-tax direct cost stemming from the company's storm restoration efforts.¹³ The following graphic illustrates the pace of restoration efforts:¹⁴



A follow-up study of Isabel's impacts on the Washington, DC National Capital Region (NCR), coordinated by George Mason University, revealed additional interdependencies between sectors, and brought sharper focus on the current and potential role of emergency and backup power generation:

¹² Distributed Generation: Ensuring Energy Security, Reliability, And Efficiency, U. S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory. See http://www.netl.doe.gov/scng/enduse/refshelf/Dist_Gen_brochure_final_1.pdf

¹³ Dominion Estimates Hurricane Isabel Cost at \$128 Million After-Tax , The Power Report, Thursday, November 06, 2003.

¹⁴ Source: Dominion Virginia Power website

Hurricane Isabel demonstrated that emergency planning is required not only for short-duration events, but also multi-day outages for the proper operation of on-site emergency generating units. This is needed for both government and privately owned facilities. This short and longer term planning includes the availability and distribution of fuel for these generating units. Pre-event planning and arrangements, in-place contracts, and integration of the fuel distribution procedures into public agency emergency plans are required in order to transport bulk diesel fuel (and possibly propane) in a safe and timely manner around the NCR during emergencies. This was a critical problem in the World Trade Center area in New York on September 11, 2001 where a number of operating generators shut down because of lack of diesel fuel; this increased the impact of the event and time and complexity of the recovery.

The above examples also highlight a question that has arisen since Isabel on the scope of responsibility each of the sectors has regarding the provision of redundancies. Dominion is accountable only for direct power outage and restoration, but at what point does the focus shift from their efforts to those who relied upon them? Is it reasonable to expect that power to a hospital should be restored immediately, or is it reasonable to expect that a hospital will have back-up power generation? Should the electric power generating cooperatives that depend on Dominion for power transmission contribute to restoration efforts?¹⁵

The need for reliable emergency power was further highlighted in an independent assessment of the impacts of Hurricane Isabel, commissioned by Virginia Governor Mark Warner. The assessment focused on the need for emergency and back-up power for the Commonwealth's Emergency Operations Centers (EOCs), and noted:

“The overall data management system for the EOC needs to grow beyond a basic database to a more sophisticated and integrated consequence management software suite that ties into the Virginia Department of Transportation, the Virginia State Police, the Department of Health and Human Resources [sic], and utility companies. It should comprise redundant communications and power back-up.”¹⁶

Virginia Potential For DG: The Role Of Combined Heat & Power (CHP)

Virginia has become a preferred location for many of the nation's high-technology firms, including telecommunications and information companies, e-businesses and electronic component manufacturing companies. Many companies are turning to distributed energy systems as a means for ensuring high-quality, reliable on-site generation. One of the most promising of Virginia's distributed energy resources involves CHP systems. According to the U.S. Department of Energy, existing CHP systems in Virginia have a total capacity of 2,156 megawatts, which represents 10.7 percent of total in-state capacity.¹⁷

¹⁵ National Capital Region, Hurricane Isabel: Critical Infrastructure Interdependency Report, April 2004

¹⁶ Virginia's Response To Hurricane Isabel Submitted to The Honorable Mark R. Warner, Governor of Virginia, December 2003.

¹⁷ Energy Information Administration/State Electricity Profiles 2002, Table 4. Electric Power Industry Generation of Electricity by Primary Energy Source, 1993, 1997, and 2002.

In addition to the CHP systems already deployed at some 49 sites statewide, some 3,500 megawatts of additional CHP technical potential has been identified, with the commercial and institutional sectors accounting for 57 percent of the total and industry the remaining 43 percent.¹⁸ Development of this resource could result in greater energy productivity, lower energy costs for owner/operators, the potential for reduced air pollution emissions (nitrogen oxides--NO_x, sulfur dioxide--SO₂, particulate matter, mercury, and carbon dioxide--CO₂, among others), as well as enhancing power quality, reliability, utility independence and energy security.

Figures 1 and 2 show potential CHP capacity in MW identified in commercial and institutional applications and industrial applications respectively in Virginia. The broad range of potential commercial applications – primarily in commercial buildings, schools and colleges, hospitals, motels and apartments as indicated in Figure 1 – give local governments considerable incentive for investigation to explore alternatives in both public sector and commercial applications. In addition, the recent large-scale power outages cited earlier have underscored a hierarchy of high-priority electricity needs that could well be served by CHP, with commensurate improvements in grid security, reliability and availability.¹⁹ In fact, the flexibility of CHP to service a wide range of customers is of particular relevance in Virginia, where ‘one size will not fit all’ due to the varied requirements of local jurisdictions.

Figure 1: CHP Potential in Commercial and Institutional Applications – Virginia
(Installed Capacity – Megawatts)

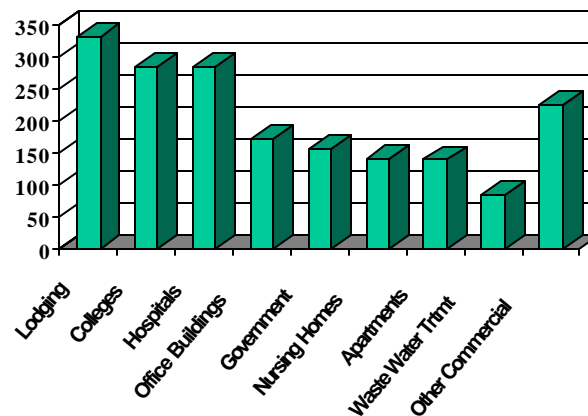
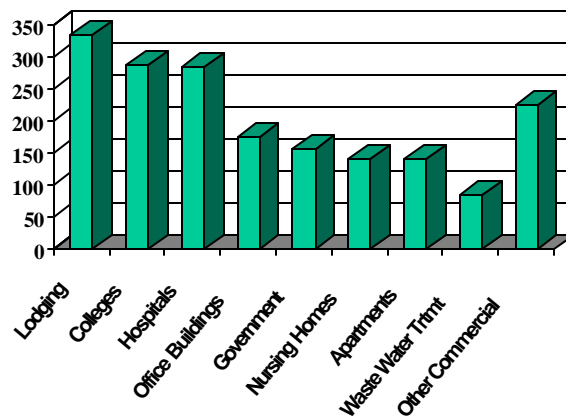


Figure 2: CHP Potential in Industrial Applications – Virginia
(Installed Capacity – Megawatts)

¹⁸ Environmental and Energy Analysis, Inc., Presented at Mid-Atlantic CHP Applications Center Roadmapping Workshop, College Park, MD, July 8, 2004. These figure represent technical potential of CHP for existing sites with conducive power and heat loads; economic feasibility was not assessed.

¹⁹ These critical needs include - but are not limited to - emergency operations centers (EOCs), police and fire departments, hospitals and critical care facilities, water and sewage treatment facilities, fuel distribution facilities, defense facilities, air traffic control, other transportation controls and cellular telecommunications service sites.



The commercial/institutional CHP market potential by size in Virginia is illustrated in Figure 3. Small and medium size categories (100kW – 1MW) account for more than 60% of the total technical market potential. The market potential is approximately 25% for CHP systems between 1MW and 5MW, and 10% for systems greater than 5 MW.

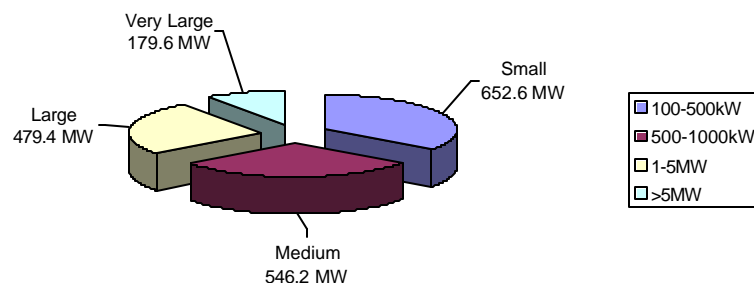


Figure 3 - Virginia Commercial/Institutional CHP Market Potential by Size²⁰

Barriers To Distributed Generation Market Penetration

General DG Interconnection Barriers

It is apparent that distributed energy systems offer significant benefits to the Commonwealth, and that over time these benefits may be realized.²¹ However, in

²⁰ Source: EEA Presentation at Virginia Tech ARI CHP Workshop, Alexandria, Virginia, June 2003

Virginia and many other states, a number of barriers impede this process. The recent DOE interconnections study categorized these barriers as primarily technical, business practice, and regulatory in nature; a brief listing is included here as a prelude to a discussion of Virginia-specific issues.²²

- A variety of technical, business practice, and regulatory barriers discourage interconnection in the US domestic market.
- These barriers sometimes prevent distributed generation projects from being developed.
- The barriers exist for all distributed-generation technologies and in all regions of the country.
- Lengthy approval processes, project-specific equipment requirements, or high standard fees are particularly severe for smaller distributed generation projects.
- Many barriers in today's marketplace occur because utilities have not previously dealt with small-project or customer-generator interconnection requests.
- There is no national consensus on technical standards for connecting equipment, necessary insurance, reasonable charges for activities related to connection, or agreement on appropriate charges or payments for distributed generation.
- Utilities often have the flexibility to remove or lessen barriers.
- Distributed generation project proponents faced with technical requirements, fees, or other burdensome barriers are often able to get those barriers removed or lessened by protesting to the utility, to the utility's regulatory agency, or to other public agencies. However, this usually requires considerable time, effort, and resources.
- Official judicial or regulatory appeals were often seen as too costly for relatively small-scale distributed generation projects.
- Distributed generation project proponents frequently felt that existing rules did not give them appropriate credit for the contributions they make to meeting power demand, reducing transmission losses, or improving environmental quality.

Virginia Barriers and Solutions

Distributed Generation (General)

The CIMAP Distributed Energy Resources Workshop held in Richmond, Virginia in May 2000 sought to adjust the national concerns as they pertained to Virginia. The workshop underscored the rapidly changing landscape of energy delivery services under current and proposed deregulation initiatives. With respect to distributed energy systems, this landscape can be characterized by the following concerns:

²¹ Including greater energy productivity; lower energy costs for owner/operators; potential for reduced emissions (NOx, SOx, and CO₂); and increased power quality, reliability, utility independence and security.

²² Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects, prepared under Subcontracts No. CXE9-29093-01 and CXE9-29092-01, National Renewable Energy Laboratory under DOE Contract No. DE-AC36-99-GO10337.

- Distributed energy resources offer a potential additional source of electrical energy supply over the next several years, with estimates ranging from 20 percent to 40 percent of installed capacity available from central power stations
- There is no agreed-upon protocol for evaluating operational and emissions characteristics of late-generation distributed resource units, including a suitable mechanism to collect up-to-date data and scale up from bench test to on-line operation
- There is a similar absence of an appropriate methodology for incorporating distributed generation technical and human risk factors into distribution system operations
- New business models are needed based on new technologies and a changing regulatory environment
- A revised tariff structure, philosophy and payment allocation to incorporate distributed generation will be required
- Integrated resource planning for a distribution feeder in a deregulated market based on probabilistic planning criteria will be necessary
- Standards and restrictions for gas-fired distributed resource units should be re-assessed, based on state-of-the-art pollution control abatement technologies permitting greater hours of operation, including possible operation in a peak-shaving mode
- The availability and reliability of the gas distribution system, particularly as it relates to new distributed generation units, may be a greater liability than the electrical transmission grid

Distributed Generation and Local Government: The Special Case of CHP

Collectively, Virginia local governments spend in excess of \$300 million annually for electricity. Faced with the prospect of electricity deregulation, local governments are seeking to gain both cost savings and experience for future competitive purchase of electricity. Dominion Virginia Power recently agreed to permit localities to participate in a Pilot Program for the aggregation and competitive purchase of up to three percent of local government annual electric energy needs. In Arlington County, for example, which has over 200 electric accounts for general government, the five accounts included in the pilot program represent one third of the County's total electricity use and cost; the cumulative annual cost of these five accounts is \$1.68 million.

If local governments have access to clean, efficient, and reliable DG electricity services, they can ensure both additional power and better air quality while providing an enhanced climate for continued local economic growth.²³ In addition to making efficient use of

²³ The reader is cautioned that much of the existing stock of potential DER assets consist of diesel emergency backup generators without pollution control equipment. When operating these units emit high levels of particulate matter and nitrogen oxides (NOx). These emissions are particularly of concern on hot summer days conducive to smog formation, which are often times of peak power demand when DER assets would be most valuable for peak shaving. Air regulations and permits typically limit the size and hours of operation for diesel emergency backup generator use.

Virginia's energy resources, they can market their 'green' credentials as working on behalf of the public interest. In non-attainment area jurisdictions, this may provide a potential air emissions offset to allow new development to take place.

An additional benefit of DER for public sector entities is the increased security, independence and reliability associated with a stand-alone energy source. Local jurisdictions are already improving their response capability by developing a comprehensive energy shortage response plan. The plan serves as a tool for effectively assessing and responding to energy emergencies due to supply disruptions or natural or man-made disasters. An effective plan should be customized for each local jurisdiction.

As the DOE study revealed, CHP offers considerable systems applications for local governments. However, if the market potential of CHP is to be realized in Virginia as part of a local government program, it must overcome several significant barriers, particularly with respect to financing, regulations, policy and information. The ability to successfully address each of these will ultimately determine whether local governments can derive benefits from CHP. These barriers, along with possible initiatives to overcome them, are discussed in this section.

Financing Barriers

For CHP to be considered an attractive option to Virginia's local governments, it first has to be financially viable, which can present significant obstacles. This is due in part to the availability of inexpensive grid-based power; Dominion Virginia electricity prices (excluding transmission) currently are 39 percent lower than the national average and constitute the fourth lowest price of the thirty generating regions.²⁴ In addition, CHP high capital costs and high perceived risk for conventional lending sources may preclude CHP development without creative financing alternatives. Since some 60% of Virginia's CHP potential lies in smaller industrial/commercial customers, financing these systems becomes even more problematic when viewed from strictly a 'bottom line' perspective without a commensurate reduction in transaction costs.

Although local governments may be interested in smaller installations, they cannot afford to be taking risks. Small installations may have a high technical risk component, and this will be an implementation barrier. If small installations are a large market, the risk will have to be mitigated up front. From an experience perspective, financial entity and potential CHP customer unfamiliarity with new technologies increases perceived risk and - particularly for small installations - reluctance to become an energy facility stakeholder.

In addition to the front-end capital costs, other CHP financial hurdles include high standby power rates (for supplemental power, usually from the interconnected electric grid), the absence of significant tax incentives, and overly restrictive policies for the depreciation of CHP systems. For commercial CHP systems, the depreciation period can be as long as 39 years, depending upon the facility owner. Current federal interest has focused on investment tax credits and accelerated depreciation, with six bills introduced into the 107th Congress that included tax incentives for CHP. All six have included some

²⁴ Derived from Energy Information Administration, Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions Report."

form of investment tax credit, while only one has included shortened depreciation. In addition, significant discussions have occurred in the Senate about shortening depreciation for CHP facilities, tied to reclassification of CHP as a pollution reduction technology.

Because of CHP's environmental and efficiency advantages, some (but not all) proponents argue that tax incentives should be provided to insure CHP movement into the mainstream market. However, the best form and the appropriate details for such incentives are somewhat subjective, and ultimately involve a social choice – that is, there is no ‘best’ approach. Use of third parties to develop, finance, or otherwise participate in a project may facilitate full use of tax incentives for CHP. As noted earlier, in many cases the ultimate consumer may be unable to benefit fully from tax credits or accelerated depreciation (e.g., because of non-taxable status, lack of sufficient taxable income, the Alternative Minimum Tax (AMT), or business credit limitations). Certain devices exist (e.g., sale-leasebacks) that may allow the benefits to be shifted to a third party who can fully utilize the credits or depreciation. Another approach to high up-front capital costs employs Energy Saving Performance Contracts, which allow the saving to be shared between the system owner and an energy service company (ESCO).

In general, public agencies cannot become signatories to shared savings contracts with private companies where tax-exempt financing is used. However, an alternative arrangement - shared savings contracts – can allow ESCO financing in these instances based on higher commercial interest rates. Under such an arrangement, energy savings from the project are guaranteed to meet or exceed a certain minimum amount -- either the full amount or a percentage of the savings, while the public agency incurs no out-of-pocket expenses.

Virginia legislation allows local government to engage in performance-based contracting in order to “encourage public bodies to invest in energy conservation measures and facility technology infrastructure upgrades that reduce energy consumption, produce a cost savings.” However, third party financing of CHP systems is complicated by the tax-exempt status of local government, which can spend tax-exempt money only for tax-exempt purposes. Since these tax-exempt funds cannot provide benefit to the private sector, by Internal Revenue Service (IRS) regulations, Virginia law permits setting up public-private partnerships. A private entity gets an incentive to invest in a project. The IRS allows the revenue streams to be used to pay off debt on the project, but when the debt is retired, the asset reverts back to the government.

In addition to meeting the overall cost of the CHP system, district energy systems face another challenge: meeting the cost of a thermal distribution system.²⁵ Unlike power output, the infrastructure necessary to distribute thermal output to end-users is not always present. One way to address this problem, which is supported by the International District Energy Association (IDEA), would include thermal distribution facilities in the definition of CHP assets qualifying for the ITC.

²⁵ District energy systems produce steam, hot water or chilled water at a central plant for distribution to buildings in the district for space heating, domestic hot water heating and air conditioning. Although these are not CHP systems, they are considered as distributed energy systems.

Barriers to financing have been successfully overcome by streamlining procurement procedures – for example, pre-qualification of bidders. In Federal government regional agencies, there are lists of pre-qualified energy service companies (ESCOs) that are able to finance up-front construction capital. At the state level, the Virginia Department of Mines, Minerals and Energy (DMME) has a list of pre-qualified ESCOs for state agencies to deal with. Cost savings due to CHP efficiency, which occur over the life of the project, accrue financial benefit and are used to repay the capital. This approach has been particularly helpful in federal government because capital funds are scarce. In addition, the Virginia Department of Mines, Minerals and Energy (DMME) recently identified a series of renewable energy incentives for Electric Production, which should provide additional incentive for development of distributed energy systems.²⁶

One of the more widely adopted initiatives in a number of states, but not Virginia, is the Public Benefit Funds (PBF), which was cited by DMME as one specific measure to assure continued support for renewable energy resources, energy efficiency initiatives, and low-income support programs. These funds, which are typically state-level programs developed through the electric utility restructuring process (These funds are also frequently referred to as a system benefits charge, or SBC), are most commonly supported through a charge to all customers on electricity consumption, e.g., 0.2 cents/kWh. Examples of how the funds are used include: rebates on renewable energy systems and fuel cells; funding for renewable energy R&D; and development of renewable energy education programs.

The notion of a public benefits fund in Virginia has strong local government appeal, but may be difficult, politically, to enact, especially since most PBFs get started during electric restructuring, not afterward²⁷. A different model, representing a more corporate approach, could be that of the North Carolina Advanced Energy Corporation, which receives core funding directly by the utilities under direction of the North Carolina Public Utilities Commission. Some permutation of a public benefits funded-, or mandated direct utility funded- institute to meet Virginia's needs could be created to further address CHP and many other energy issues. However, there is a strong reluctance in the General Assembly to enact new taxes, fees, and charges.

Regulatory Barriers

One of the strongest arguments for CHP systems is based on the decreased air pollution emissions when compared with a central fossil-fired system providing the same thermal and electrical services. However, the Clean Air Act was not written with energy efficiency and renewable energy in mind, and focuses primarily on end-of-the pipe controls through input-based standards, which means that CHP systems actually must face daunting regulatory constraints.²⁸

²⁶ Renewable Energy Incentives for Electric Production, Report to the Commission on Electric Utility Restructuring and Coal and Energy Commission, Prepared by the Virginia Department of Mines, Minerals and Energy, September 8, 2004.

²⁷ For background and experience in other states see <http://www.aceee.org/press/u041pr.htm>

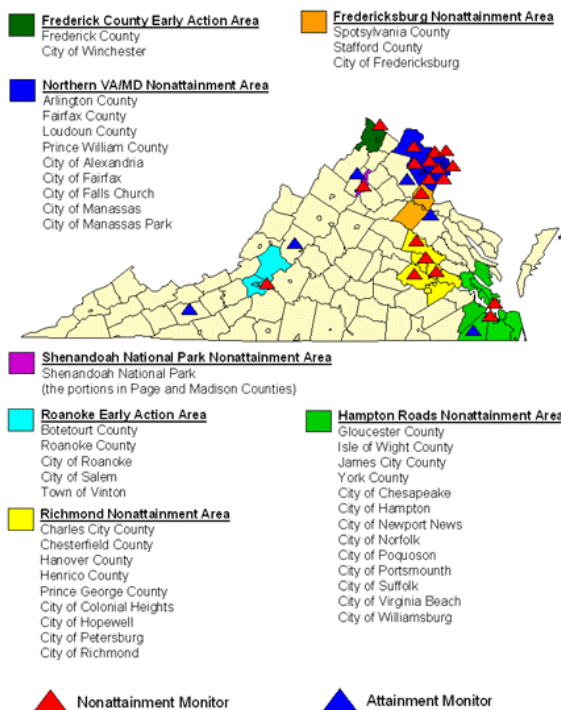
²⁸ Most emissions limitations for energy facilities are based on pollutant emissions per unit of energy input as fuel (often expressed as pounds of pollutant per million British thermal units [Btu]) rather than on the

Under the Clean Air Act, states are required to establish State Implementation Plans (SIPs), which have specific requirements for new sources. Airsheds exceeding standards for specific ‘criteria’ pollutants - including ozone (O₃) and NO_x – are known as nonattainment areas and are required to develop more stringent air quality management plans; the following figure demonstrates Virginia’s current air quality status:

basis of useful energy output (pounds per megawatt-hour of electricity or Btu of useful heat energy). CHP proponents favor output-based emissions standards because they recognize enhanced energy efficiency while input-based standards are seen as rewarding additional fuel consumption. See U.S. EPA, "Output-Based Regulations: A Handbook for Air Regulators," April 22, 2004.

Figure 4: Recommended Localities for Ozone Non-attainment Designation²⁹

Enclosure II The Commonwealth of Virginia



8-hour Ozone Nonattainment Area Boundary

For attainment areas, a “major” point source is defined as having volatile organic compound (VOC) or NO_x emissions exceeding 50 tons/year. In the case of a nonattainment area, the criterion level drops to 25 tons/year. Control of VOC and NO_x in nonattainment zones must meet Least Achievable Emissions Rate (LAER), a standard that is stricter than BACT. LAER does not allow consideration of economic feasibility in establishing control requirements, in contrast to BACT. A further New Source Review (NSR) requirement for permitting stationary sources in nonattainment areas is that emissions increases must be offset by corresponding emissions reductions at a rate of 1.2 tons of reduction for each ton of increase.

EPA, in its NO_x SIP Call rule required Virginia and twenty-one other Eastern states and the District of Columbia to update their SIPs so as to achieve better controls and greater reductions in NO_x. This is needed to achieve ozone attainment both locally and regionally, due to interstate transport of NO_x. Each state subject to the NO_x SIP Call has developed its own rules and strategies for achieving needed NO_x reductions.

²⁹ Source: Virginia DEQ.

In Virginia, NOx SIP call regulations established a statewide NOx cap-and-trade program. The great majority of DER/CHP facilities are not at utility central plant scale and will not participate in the Virginia NOx cap-and-trade program, at least as currently configured. The most likely scenario is that large facilities will continue to emit up to their cap, and regulators are likely to view CHP emissions as “leakage” contributing to the emissions problem, because they will add to capped emissions. An additional flaw in the permitting regulation is that no credit is given to a facility for utility emissions that it displaces. The issue of “crediting” CHP-based emissions reductions, including ensuring associated utility emissions reductions compliance, also needs to be resolved, as well as how to address possible local emissions from a new CHP facility.

In recent years, however, many state organizations and EPA have sought greater integration of energy, air pollution, and transportation control strategies and regulatory efforts, particularly with ‘credit’ for the thermal energy contribution, which could help affected localities to more quickly comply with increasingly stringent state and federal air quality standards. In Virginia, air emissions standards are poised to become a major determinant affecting local development. Local governments must spend money to come into compliance, so they are potential large ‘anchor’ customers. Getting credits for air emissions reductions transferred into SIP plans is important in getting localities to come on board as anchor customers. It is therefore imperative to define what further work needs to be done to get emissions credits properly acknowledged in the SIP.

There is general agreement that Virginia is not taking advantage of existing opportunities, such as EPA-allowed “set aside” credits for renewable energy. Virginia regulatory standards are still heat value input-based, due in part because useful heat output may be difficult to assess. In addition, there is no mechanism to take into account offsetting across sectors; thus a utility will not get credit for buying low-emissions transportation or residential heating.

More information from EPA through the CHP Partnership will be helpful in obtaining verification of the quantified benefits of CHP. Permits must be enforceable and regulators need to understand well-defined impacts such as explicit reduction in emissions. However, CHP issues are often less concrete, and regulators may not feel comfortable with the idea that one facility will increase emissions but be offset by emissions reductions elsewhere.

CHP is already proposed for inclusion in some renewable portfolio standards, although it is not strictly renewable energy, because it represents such a vast improvement in both efficiency and output-based emissions. Studies are trying to quantify the CHP benefit, and this will help it gain wider acceptance. There are some recent precedents: Texas has done streamlined CHP permitting, and California has a certification system for small CHP systems with expedited permitting. New York, Texas, California and Delaware have focused on trying to standardize interconnections, while New York and California have looked at standby rates and exit fees.

Policy Barriers

The development of CHP systems is also limited by policy concerns affecting interconnection and grid access, utility tariff and contract provisions, and access to backup power and supplemental power at reasonable costs. Many of the concerns over the reliability and safety aspect of grid interconnection are being addressed through the development of uniform national standards; however, considerable additional work is needed to develop a uniform, accelerated study and review process prior to a signed agreement with the relevant utility.

However, policy impediments to CHP development also can be found at the state and local government level. Current zoning, building and fire codes do not address many newer CHP technologies, and local code officials may be correspondingly unfamiliar with the technologies, and questions arise over their implementation as a permitted use.

One proposed policy measure that would have significant environmental consequences entails state recognition of CHP as a pollution reduction initiative, reducing or eliminating property taxes for CHP facilities independent of ownership. Another measure, recently included in the metropolitan Washington Council of Governments (MWCOC) NO_x SIP call response, would be to enlarge the application of the EPA "innovative measures" policy to include CHP systems. The EPA currently allows SIPs to include up to three percent of planned emissions reductions from innovative measures. Innovative measures can include various energy efficiency and renewable energy options and such things as reducing urban heat island effects that traditionally have not been considered or required under conventional air pollution regulatory programs.

Many CHP proponents argue that for CHP systems to realize full market penetration, a policy shift from input-based to output-based standards will be required. There is general agreement that while output-based standards would greatly benefit CHP adoption, other scenarios such as the recent increase in oil prices, utility restructuring and increased concerns over security of supply could accelerate this process in the near term.

Information Barriers

Significant market penetration for CHP systems ultimately depends on awareness of the technology's efficiency, cost savings and environmental benefits for local governments. "The greatest progress toward decreasing the environmental permitting barriers to CHP has been due to the increased awareness of environmental regulators regarding the benefits of CHP," according to the American Council for an Energy-Efficient Economy (ACEEE). "We now need to see this awareness translated into regulations that recognize the unique benefits conveyed by the energy efficiency of CHP systems."

The US EPA is attempting to promote awareness through its CHP Partnership Program, with a goal of 21 gigawatts of new CHP capacity by 2010.³⁰ The EPA Partnership program can assist both with planning a CHP installation as a cost-effective pollution reduction strategy and helping regulators to develop output-based standards linked to

³⁰ Information provided by Christian Fellner, EPA Climate Protection Partnerships Division at May, 2003 ARI Workshop on Combined Heat and Power Development in Virginia.

generation efficiency. According to an EPA CHP Partnership representative, EPA tries to be an independent third party that can present accurate, unbiased information to the people.

In parallel with EPA activities, the US Department of Energy (DOE) launched a CHP Challenge program in 1998 designed to remove institutional, regulatory, and market barriers to expanded use of combined heat and power. The goal is to double the U.S. cogeneration capacity by 2010, to a new total of approximately 100 gigawatts. The CHP Challenge program works with federal and state agencies, private organizations, and trade groups to raise awareness of the energy, environmental, and economic benefits of combined heat and power, including its use in district energy systems.

There are several initiatives of potential value to Virginia in the development of its CHP resources. The most directly relevant is the newly established Mid Atlantic Combined Heat and Power Application Center, created with funding from the US DOE to promote the use of CHP in the Mid-Atlantic Region. The objectives of the Center, based at the University of Maryland, are to reduce the perceived risk of CHP to users, foster CHP as a viable technical and economic option for the participating region, and capitalize on existing regional CHP resources.

Other national programs, such as the EPA Landfill Methane Outreach Program, EPA Green Power Partnership and EPA AgStar, offer technical support for CHP projects based on methane emissions from sanitary landfills (attractive to local government) and agricultural sites. For example, New York State recently announced a program to provide \$14.5 million for thirty-six new distributed generation and combined heat and power (CHP) projects to enable commercial, agricultural, and industrial energy users throughout the State to generate their own power from waste heat, or other sources, such as landfill gas. Although these projects are seen as producing benefits for the environment, cutting energy costs, and decreasing dependence on the grid, the benefit-costs of such projects in northeastern US states can differ markedly from those in Virginia with its low electricity prices.

The New York state CHP program has benefited from more than just cost considerations. In the 1980's, for example, the state government funded publication of a cogeneration manual aimed at multifamily housing that provided a question and answer section, a financial analysis form, and examples. The manual also listed technologies as well as an analysis of six projects. This kind of guide, updated to include the latest case studies as well as issues such as taxes and depreciation, would go far in educating local government decision-makers. In the words of one local government official attending the 2003 ARI workshop,

“I was initially reluctant to come to the workshop today because I didn't know about the subject . . . I'm beginning to understand what a “CHP facility” means . . . CHP fills a void that has not been addressed in the community . . . Well, that's something I can get my hands around.”

A Utility Perspective on Distributed Generation

The following remarks summarize a presentation by Dominion Energy to the 2002 ARI Distributed Resources workshop³¹. They are not a verbatim transcript.

The changing world of deregulation and its implication for transmission, distribution, and retail sales directly affects Virginia utilities. As it is possible that incumbent utilities may in the future only supply one service, the fundamental question is what will drive a utility to be interested in distributed generation? Simply stated, how can distributed generation affect the utility's ability to take care of customers, and control costs/profitability?

When utility service is unbundled, relationships between players change – in fact, a utility may not even sell energy in the future. Utility view of distributed generation thus depends on what market business the utility is in. Each business sells a different product to a different set of customers. Depending on point of view, distributed generation may be an important business option for serving load, or a potential supply source. Use of distributed generation then becomes an economic decision.

With respect to transmission and DER, the regional transmission organization (RTO) (not the utility) controls policies related to this because they set up market rules. The RTO planning process is where distributed generation fits in here.³² However, with respect to distribution and DER, there are potentially strong linkages to distributed generation regarding impact on safety, reliability, cost, and distribution rates. The effects can be either positive or negative. For example, who should pay for incremental upgrade of transmission line that is already fully loaded, when a distributed generation operator proposes to deliver distributed generation on that line? Must look at flow of benefits, economic principles.

Distributed generation can affect sales and revenues across the market. The value proposition of distributed generation depends on which part of the business you are in, and – particular - understanding the relationship between distributed generation and retail supply function. Distributed generation may be a valuable part of a utility's supply portfolio, especially as part of a broader market; in that context, distributed generation is a potentially valuable and innovative source of energy. It will be important to have consistency between FERC rules and state rules to have effective implementation of the technology.

Active participation by state regulatory representatives at the RTO level would be beneficial, since RTO committees and proceedings will establish many market policies for DER. Local interconnection rules for generators and other resources also should be consistent with RTO standard interconnection processes to avoid

³¹ "Distributed Resources: An Investor-Owned Utility Perspective" Presentation by Harold W. Adams, Jr., P.E. Dominion Energy, at 2000 ARI Distributed Resources Workshop, Richmond, VA.

³² In general, RTOs are primarily concerned with the efficient and reliable operation of the transmission grid in specific regions. RTOs are required not to have an economic interest in buying and selling power.

duplication of effort by developers and transmission and distribution service providers. In addition, to the extent that the distributed resources may provide societal benefits, tax incentives for their development may be appropriate as opposed to special treatment under utility rates. Distortion of market operation should be avoided.

Roadmap to the Future: Developing Virginia's Potential

Distributed Generation and Information

Following the June 2004 ARI workshop in Charlottesville, a local government participant stated that - compared to the rest of the country - there is a void of information and resources for efficiency and innovations in Virginia. Dissemination of case studies of successful DG systems in Virginia, as well as information about other innovative energy applications and deployments in the state, would provide the necessary (if not sufficient) incentive for resource development. The DEQ now features a Combined Heat & Power/Distributed Energy Resources Pages link in its Innovative Technology website; this provides a link to a variety of useful state, federal and private sector resources.

In particular, the university community in Virginia has many of the characteristics of local government, in the sense that operating a cluster of government facilities is not unlike operating a university campus. A survey of university-based research programs, installed distributed energy facilities and decision-making tools would be of value and a useful outreach to local authorities with jurisdiction and a need to educate small businesses.

As the DEQ and ARI workshops have shown, EPA and DOE programs have so far seen only limited success in promoting CHP, and the information linkages to local government need to be strengthened. The nascent Mid Atlantic Combined Heat and Power Application Center provides an additional link, and has the added advantage that it provides a necessary regional context for Virginia's energy planners.

Another stakeholder with this mandate is the US Combined Heat and Power Association (USCHPA), which was formed in 1999 to bring together diverse market actors interested in CHP and to promote CHP at a national level, including endorsing federal public policy that benefits CHP efforts. More information from EPA, DOE and associated national laboratories is needed to verify the quantified benefits of CHP, and the USCHPA outreach to local government can assist in getting the message out.

Even with the ongoing Federal initiatives, many of the remaining challenges facing CHP are now found at the state and local level. The emergence of state and regional policies, programs, and other initiatives have begun making progress overcoming information barriers. New York, Texas, California and Delaware – assisted by such organizations as USCHPA - have focused on trying to standardize interconnections and develop new policies for standby rates and exit fees. Several states have published manuals on permitting distributed generation, to educate the public. Several years ago New York State funded publication of a cogeneration manual aimed at multifamily housing. The

manual included useful technical information, along with a question and answer section, a financial analysis form, and analyses of six representative CHP projects.

To paraphrase one northern Virginia local government official, “We are not afraid of something new, but when we take a risk, we need as much information as possible.” Most government entities have set procedures they must follow and have no business assuming the risk of innovative technology. When they do assume risk, they need as much information as possible. Promoters tend to leave out details in their presentations, listing only the goods points, not the weaknesses or risks. In view of the concerns cited in this review, an updated how-to-do-it manual reflecting recent advances in CHP and micro-CHP systems would allow Virginia local governments to both advise relevant commercial market CHP developers and address tax and depreciation aspects of public sector CHP projects.

Distributed Generation and the Regulatory Process

The security of the grid and the fuel supply is a matter of broad public concern, and security failures have very large public risk and cost consequences. However, investors do not base their decisions on these public concerns. Rather it is generally the government and public, not the generators, who bear those costs and risks.

Many aspects of security are public goods, where benefits are provided to everyone, including those who do not pay for them. For example, long-term investments in renewable energy will reduce the risk to the public of pipeline interruptions and central station outages. Yet if the security benefits of renewable energy, while shared by all, are paid for by a few, investments in renewable energy will continue to fall short of our collective needs. Regulatory reforms are needed to assure that private investment decisions reflect the networks security needs.³³

The Virginia State Corporation Commission is charged with initiating the transition -- over a period of time -- from a wholly regulated environment to a fully competitive, market-driven system. However, the SCC points out that “it is noteworthy, however, that both the PJM³⁴ model and the Federal Energy Regulatory Commission Standard Market Design model effectively shift oversight responsibility for transmission and generation reliability from the states to the FERC.”³⁵

This changing regulatory environment may present a dilemma with respect to energy security and reliability. As the Regulatory Assistance Project (RAP) notes,

³³ Issuesletter: Electrical Energy Security: Policies for a Resilient Network (Part 2) Author(s): Regulatory Assistance Project Date: April 2002

³⁴ PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia and the District of Columbia.

³⁵ Report To The Legislative Transition Task Force Of The Virginia General Assembly: The Feasibility, Effectiveness, And Value Of Collecting Data Pertaining To Virginia’s Energy Infrastructure, Pursuant To Senate Bill 684 Enacted By The 2002 Session Of The General Assembly Of Virginia, November 20, 2002

“In the face of a restructured and highly competitive electricity marketplace, government determines the right set of policies and incentives for electric systems to become more resilient and capable of withstanding coordinated attacks. It is not clear, however, just what incentives would attract private investment for building redundancy, toughness, reliability, and the capacity to recover quickly from an attack. While it is clear that some of the current R&D and investment in new equipment and systems will have a beneficial effect on counter-terrorism goals, additional measures will be required.

For example, would an approach similar to the Strategic Petroleum Reserve be feasible? That is, could a “strategic electricity reserve” be constructed that would include critical equipment spares placed near important urban centers of the country? How might public-private partnering—bringing to bear the full capabilities of the industry, its suppliers, and the federal government, including efforts under way at the national laboratories—enter into this concept as well as into fulfilling the longer-term R&D needs? How, for instance, might increased reserve generation capacity be provided? Such questions must be thoroughly addressed if we are to adequately protect the nation’s electric power system, its economy, and the well-being of its people.³⁶

The Regulatory Assistance Project concluded that physical security needed to be viewed as an integral element of system planning, and outlined policies for regulators and utilities to improve the security of the nation’s power systems by strategically evolving a more resilient electric network. In this paradigm, ‘resilient’ networks could be enhanced by the incorporation of distributed energy systems. Properly developed, these would reduce the number of critical facilities that, if lost or damaged, would lead to widespread, cascading impacts.

Toward that end, the RAP posited the following necessary regulatory changes:³⁷

- Require Utilities To Analyze The Reliability Benefits Of Lighter Loads And More Distributed Resources

The key to the resilient network is a design architecture based on lighter loads and more distributed resources. As a first step, regulators should require utility engineers to model regional and local grids at different load levels and identify the critical facilities (power plants, transmission links, and key substations and control centers) whose loss would cause serious reliability problems in a city or region. Three different types of critical grid facilities should be identified: a) those few key facilities that must be actively secured against deliberate attack; b) those that can be supported by strategic investments in power supply or transmission (for example, adding power lines to change a radial system into a more stable network.); and c) those that can be rendered less critical through

³⁶ Making The Nation Safer: The Role Of Science And Technology in Countering Terrorism, Committee on Science and Technology for Countering Terrorism, The National Academies Press, Washington, D.C., 2002.

³⁷ Issues Letter - Electrical Energy Security: Policies for a Resilient Network, Part II, April 2002.

investments in efficiency, load management, and distributed resources. Limited security budgets should be focused very strategically.

- Support Increased Efficiency And Encourage Demand Response In Power Markets

A host of policy options are available to utilities and policymakers to accelerate cost-effective demand management. The most important options are: building codes and appliance efficiency standards; system benefit charges, utility efficiency programs, and other sources of funding for efficient end-use technology; demand-side bidding, price-responsive load and other tools for enhanced demand response in regional power markets; ratemaking plans for utilities that eliminate the utility's profit incentive to promote sales (most promising are performance-based plans using revenue caps in place of price caps); and rate designs for retail sales that encourage customers to shift consumption away from high-cost power periods when reliability is usually most at risk.

- Adopt Rules That Simplify Distributed Generation Interconnections and Allow Distributed Resources To Displace More Expensive T&D Upgrades

Distributed resources can improve reliability and forestall very expensive upgrades at the substation and local distribution level. Utility and environmental regulators now possess a number of effective tools to support increased investment in cost-effective distributed generation. The most important are interconnection standards and distribution utility policies such as distribution-level planning, targeted efficiency programs, distributed resources development zones, and de-averaged buy-back rates that reveal the full value of distributed resources in different locations. Improved wholesale market rules should permit small generators to compete with central station units to provide energy, capacity, and ancillary services in wholesale power markets. Output-based environmental standards are also needed to promote fair competition among distributed generators without degrading local environments.

- Adopt Policies That Diversify Fuel Supply Risks

Overdependence on fossil fuels generally, and on natural gas in particular, increases both security and price risks. A conscious strategy of diversified resources adding meaningful proportions of renewables, combined heat and power, and high-efficiency combined cycle generation to the electric grid will make the power grid more resilient and improve the nations energy security. Renewable portfolio standards, system benefit charges, and green power options are some of the best options available to regulators. In addition, it appears that the vast majority of electric customers will be served by traditional franchises or default service providers for some time. For these customers, regulators need to ensure a balanced resource mix through utility resource planning or portfolio management that meets long-term public goals, including price stability, environmental quality, and energy security.

Distributed Generation and Interconnection

The DOE study on interconnections cited several key factors influencing the market penetration of distributed generation systems. The principal factors include the development and adoption of uniform technical standards for interconnection, the success of individual state regulatory proceedings on distributed generation, and programs implemented by individual utilities. The recently adopted IEEE technical standard removes one major impediment to distributed energy systems by addressing legitimate utility concerns for safety and power quality.³⁸

Historically, utility interconnection procedures have been oriented toward large generators. The 2003 FERC proposed Standard Interconnection Rule for small generators applies to the interconnection of generators no larger than 20 megawatts in size with the approximately 176 investor-owned public utilities that own, control, or operate interstate transmission facilities.³⁹ This is of particular import for Virginia, for - as noted earlier in this report - small and medium size categories (100kW – 1MW) account for more than 60% of the total technical market potential.

The proposed rules, which were developed with significant input from the National Association of Regulatory Utility Commissioners and the participating state regulators, are designed to reduce the time and cost for generators to interconnect by developing special procedures appropriate for small generators, expedite the development of new generation infrastructures, and facilitate the introduction of new technologies. Still to be addressed are other issues, including what portion a customer should pay for utility upgrades that the utility owns, backup fees, and recognition of potential benefit to utility of grid support as opposed to burden to the utility and the ratepayer.

Distributed Energy: A Bright Future, With the Right Information

Virginia has a large resource base for development of distributed energy resources. Although difficult to quantify totally, the technical potential for additional CHP systems alone represents more than twenty percent of existing in-state generating capacity. There is little doubt that the combination of Virginia's low utility electricity prices and legitimate utility concerns over incorporation of distributed resources have deterred development of many projects, but it also is apparent that the joint impacts of increased security concerns for local government, air quality concerns (particularly in non-attainment areas) and a better understanding of the technical and financial characteristics of distributed energy resources are lowering the barrier. Many of the technical interconnection concerns are being addressed through federal efforts, but policy changes are needed at the state and local government level to level the playing field for project developers, utilities and the end user. In the near term, making information available to local governments and the private sector is essential to ensure that the policy issues are addressed in an open and equitable manner.

³⁸ IEEE P1547 Standard for Interconnecting Distributed Resources with Electric Power Systems

³⁹ Standardized Proposed Interconnection Rule for Small Generators Fact Sheet, FERC Docket No. RM02-12-000, July 23, 2003